

Research Summary

Evaluation of Recycled Components in Stone Matrix Asphalt Mixes

The use of Stone Matrix Asphalt, or SMA (also known as Stone Mastic Asphalt), has become popular on interstates and other routes with heavy traffic. However, Missouri is one of the states which currently does not allow use of recycled materials in the SMAs despite the routine inclusion of recyclates in dense-graded Superpave and non-Superpave (BP1, BP2, and BP3) mixtures. Within that backdrop, the Missouri Department of Transportation (MoDOT) commissioned this study with the following overarching goals and objectives:

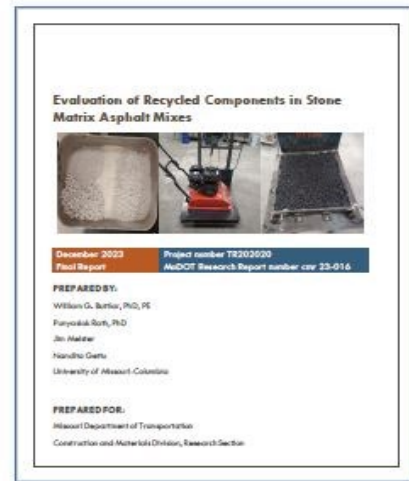
1. To evaluate the performance of Missouri SMA mixtures incorporated with RAP (Reclaimed Asphalt Pavement) and GTR (Ground Tire Rubber), based on mixture tests for cracking and rutting. Per MoDOT's recommendation, the IDEAL-CT test was used to control cracking resistance, while the Hamburg Wheel Track test was used to control rutting resistance.
2. To explore various Balanced Mix Design (BMD) strategies, such as air void regression and the use of softer binder grade, particularly as a means to produce mix designs with passing cracking test results.
3. Investigate the effect of incorporation of recycled components on the frictional properties of SMA mixtures, including

assessing the abrasion resistance of aggregates, quantifying the shape characteristics, and measuring skid resistance using a suite of laboratory tests, along with a field experiment involving skid trailer testing.

The two-phase study concluded the current use of conglomerate (non-homogeneous), unfractionated RAP stockpiles poses practical limitations in achieving passing balanced mix designs at higher levels of RAP, and the use of recycled GTR appears to be a viable avenue for incorporating recycled materials into Missouri pavements.

"Additional lab and field friction testing is also recommended as MoDOT begins to modify specifications to allow recycled materials in SMA mixes."

Based on the findings and conclusions of this study, it is recommended that MoDOT consider allowing RAP in SMA mixtures; however, at this time, with the use of conglomerate and unfractionated RAP stockpiles, an upper limit of 15% asphalt binder replacement (ABR) from RAP is also recommended. Alternatively, for simplicity, an upper limit of 20% RAP by weight of mixture could be established. MoDOT has recently begun allowing the use of GTR in Superpave and SMA mixtures. The research



conducted in this study supports the continued and increased usage of GTR as a possible approach towards achieving good mixture durability, skid resistance, and economics while promoting mixture sustainability.

Several open research questions, such as the long-term performance benefits of modifiers such as recycling agents (rejuvenators) and various warm-mix products, were posed as a result of this study, and it is recommended that additional research be conducted to address these. Additional lab and field friction testing is also recommended as MoDOT begins to modify specifications to allow recycled materials in SMA mixes.

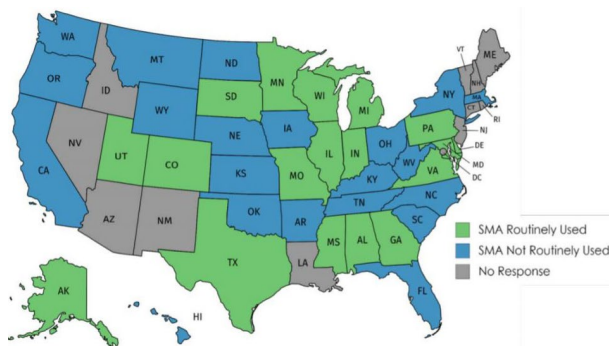


Figure 1: Use of SMA mixes in the USA

Project Information

PROJECT NAME: TR202020—Evaluation of Recycled Components in Stone Matrix Asphalt Mixes

PROJECT START/END DATE: July 2020-October 2023

PROJECT COST: \$320,000

LEAD CONTRACTOR: University of Missouri-Columbia/MCTI

PRINCIPAL INVESTIGATOR: Bill Buttlar

REPORT NAME: Evaluation of Recycled Components in Stone Matrix Asphalt Mixes

REPORT NUMBER: cmr 23-016

REPORT DATE: December 2023

Project Manager



CONTACT INFORMATION:

Scott Breeding
Senior Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4325
Scott.Breeding@modot.mo.gov